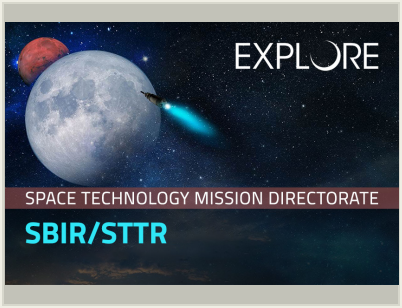
Control Suite and Teleoperator Interface for Whole-Body Mobile Manipulators, Phase I

Completed Technology Project (2008 - 2009)

Project Introduction

Robots that can move about in terrestrial environments and manipulate large and small objects serve a critical role in NASA's Moon/Mars initiative. Such systems will need to serve as precursors to human missions, collaborate with humans on-site, and carry on when humans have departed. This proposal concerns a control suite and teleoperator interface for whole-body mobile manipulators (WBMMs). WBMMs are a class of redundant, mobile, multi-limbed platforms able to use their entire bodies for manipulation tasks. Such platforms are extremely versatile and can address NASA's need for platforms that perform useful work on the surface of the Moon or Mars. To exploit WBMM, a control framework capable of exploiting redundancy and new man-machine interfaces are required. digitROBOTICS and the Laboratory for Perceptual Robotics at UMass propose to build a WBMM control suite and teleoperator interface to address these challenges. We propose to use control basis framework developed at UMass over the past two decades and used to advance the state-of-the-art in many robotic task domains including grasping and manipulation. The WBMM control suite will simplify controller design and allows control knowledge to be easily ported between robots and operating contexts. The WBMM teleoperator interface will allow for varying levels of autonomy, and can preserve safety constraints using control mechanisms from the WBMM control suite. The anticipated result of the Phase 1 effort is preliminary software for controlling WBMMs as described above at TRL 4, and a proof of concept teleoperator interface at TRL 3. The anticipated result of a Phase 2 effort would be a commercial-grade version of both the control suite and teleoperator interface, and to have the control suite and teleoperator interface running on one of NASA's WBMMs (ATHLETE or Robonaut, for example). The results of the Phase 2 effort are estimated to be at TRL 5-6.



Control Suite and Teleoperator Interface for Whole-Body Mobile Manipulators, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

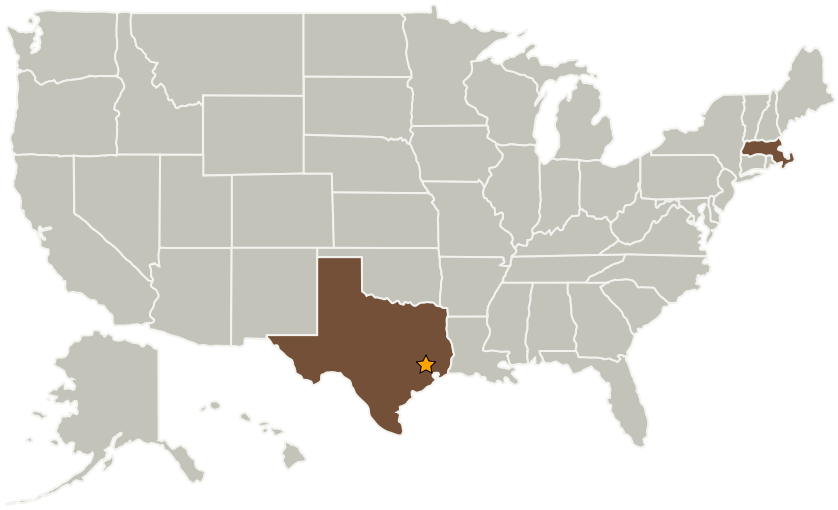
Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Control Suite and Teleoperator Interface for Whole-Body Mobile Manipulators, Phase I

Completed Technology Project (2008 - 2009)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
digitROBOTICS, LLC	Supporting Organization	Industry	South Deerfield, Massachusetts

Primary U.S. Work Locations	
Massachusetts	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.4 Execution and Control